NEMATODE PARASITES OF THE DOMESTIC PIGEON (*COLUMBA LIVIA DOMESTICA*) IN AUSTRALIA.

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(Nineteen Text-figures.)

The only Nematode hitherto recorded from the domestic pigeon in Australia, is *Ascaridia columbae* Gmelin (*Heterakis maculosa* Rud.). T. Harvey Johnston reported the presence of this parasite in New South Wales in 1909 and 1910, and recently (1918) gave a description of specimens found in Queensland. An earlier reference by Krefft (1871) to *Ascaris* sp. is stated by Professor Johnston to refer to the same species.

The material dealt with in the present paper comprises three distinct species, two of which are new for this part of the world. One of them has been found previously, only in America, and the original description of it is contained in a circular of the Bureau of Animal Industry, U.S.A., which is now out of print, and therefore difficult to obtain. In view of this, and of the very varying descriptions and unsatisfactory figures contained in most of the existing records of the other species concerned, I have thought it desirable to give fairly full notes and drawings of the specimens examined here.

The classification adopted is that used by Stiles and Hassall (1905), Railliet and Henry (1914), and Hall (1916), to whose work the reader is referred for superfamily, family, and subfamily diagnoses.

For the material examined I am indebted to Dr. S. Dodd, and Dr. J. B. Cleland.

Early in 1919 several pigeons, dying and dead, were sent to Dr. Dodd, at the Veterinary School of the University of Sydney, to ascertain the cause of the mortality among the flock. In the post-mortem examination, small filiform worms were found in fair numbers throughout the length of the intestines; but the walls of the alimentary canal appeared to be in a perfectly healthy condition, and it is doubtful whether the worms were a contributory cause of the deaths. Dr. Dodd informs me that poisoning was suspected, and that there were no more deaths after steps were taken to prevent this.

The small worms found comprised two species of Nematodes, which, on superficial examination, are very much alike, though belonging to two distinct families,—*Trichinellidae* and *Trichostrongylidae*. Apparently, Nematodes of the latter family are not at all common in pigeons. None were recorded until 1904, when Stevenson found one species in considerable numbers in the intestines of a flock of fancy pigeons at Washington, and described it under the name of *Strongylus quadriradiatus*. He states that a single specimen contained in the helminthological collection of the U.S. National Museum, which was collected by Hassall at Washington in 1892, belongs to the same species. I have not been able to find any records of later observations of this worm. All the more recent references relate to Stevenson's description. But examination of the specimens found here shows them to be identical with Stevenson's species.

In his original description, Stevenson observed that he retained, merely temporarily, the generic name *Strongylus* (properly limited to the Sclerostomes), pending an extensive revision of the whole group. By means of a diagnostic table he compared the new parasite with the three species *S. pergracilis*, *S. nodularis*, and *S. tenuis*, which he considered closely allied forms. In the following year (1905) Loos established the genus *Trichostrongylus* to include four species separated from the old genus *Strongylus*, and in 1909 Shipley added the species *Tr. pergracilis*, *Tr. nodularis*, and *Tr. tenuis*, and suggested that *Strongylus quadriradiatus* was possibly also a *Trichostrongylus*. But Ransom (1911) pointed out that *Strongylus nodularis*, and *S. quadriradiatus* differed widely from the type, and should be excluded from the new genus, and in 1912 Neveu-Lemaire included the latter in his work under the name *Strongylus ? quadriradiatus*, with the note "Ce strongyle appartient certainement à la sous-famillie des Trichostrongylinae, mais le nom générique de strongylus ne lui convient pas; sa dénomination n'est donc que provisoire."

Stevenson's species certainly does not belong to the genus *Trichostrongylus*, outstanding differences from the type being the relative sizes and positions of the bursal rays, the form of the spicules, and the vesicular swelling of the cuticle of the head. Eight other genera have been included in the sub-family *Trichostrongylinae*, but the present species does not conform to the description of any one of them. It therefore becomes necessary to establish for it a new genus, for which I propose the name *Cephalostrongylus*.

Superfamily *STRONGYLOIDEA* Weinland, 1858.

Family TRICHOSTRONGYLIDAE Railliet, 1915.

Subfamily TRICHOSTRONGYLINAE Leiper, 1908.

Genus CEPHALOSTRONGYLUS, n.g.

Generic diagnosis.—Cuticle enveloping cephalic end inflated to form a vesicular enlargement. Mouth simple, no papillae. Bursa bilobed, supported by six paired rays and one median unpaired ray; the two ventral rays close together and parallel, curved ventrally at the tips, thicker than any of the other rays; the three lateral rays arising from a common stem, but mutually divergent; externo-dorsal ray thinner and shorter than the lateral rays, given off from the base of the dorsal ray; dorsal ray still shorter, but thicker, shortly bifurcated at the extremity, the outer branches being a little longer than the inner, each of which is

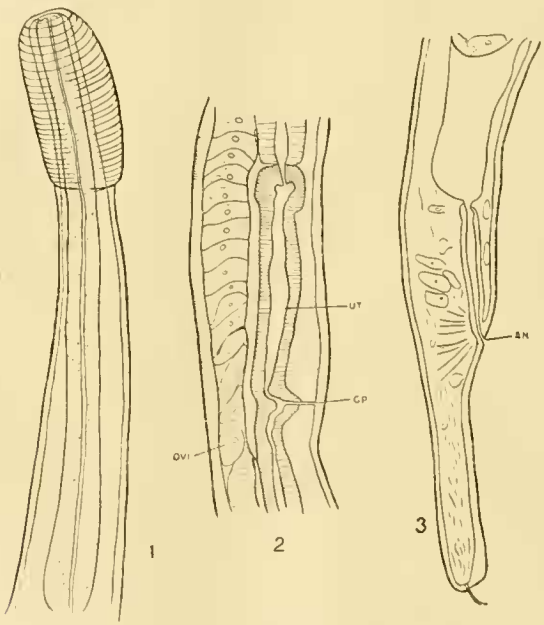
again bifurcated. Two three-pointed spicules, short and thick, joined by a membrane to form a tube; a star-shaped chitinous piece with four rays, the two lateral rays curved forward, surrounding the spicules when they are protruded. A pair of prebursal papillae. Anterior half of female body filiform. Vulva in posterior fourth of body.

Type species, *Cephalostrongylus quadriradiatus* Stevenson, 1904.

CEPHALOSTRONGYLUS QUADRIRADIATUS Stevenson.

1904, *Strongylus quadriradiatus,* Stevenson, Bur. Anim. Industry, Washington, Circular 47, 10 figs.—1905, Neumann-Macqueen, Parasites Dom. Anim., 2nd edit., p. 414.—1909, *Trichostrongylus quadriradiatus,* Shipley, Proc. Zool. Soc. London, p. 335.—1911, *Strongylus quadriradiatus,* Ransom, Proc. U.S. Nat. Mus., xli., p. 363.—1912, Neveu-Lemaire, Parasit. Anim. Dom., Paris, pp. 718-719.

The specimens in this collection agree closely with the description given by Stevenson, though the dimensions are all somewhat smaller. They were reddish in colour when first collected, and many of the females were spirally coiled, especially towards the anterior end, which, being long and filiform, gave them

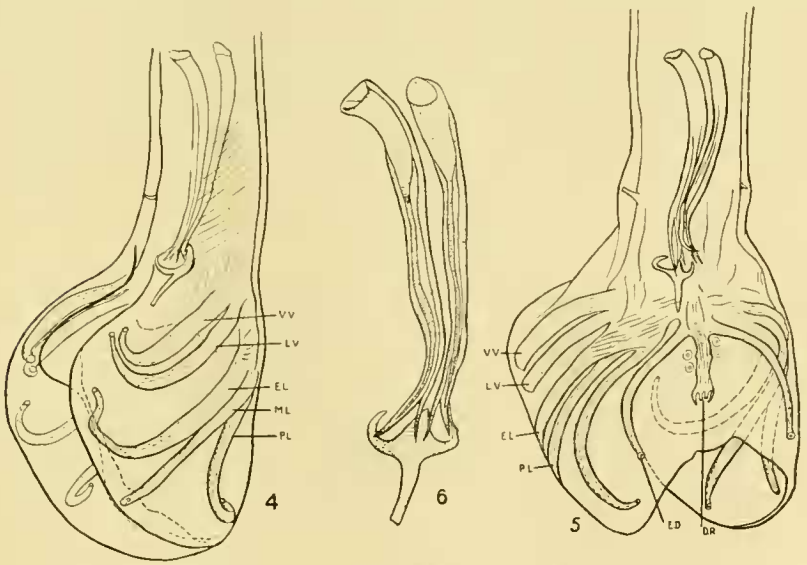


Text-figs. 1-3.—*Cephalostrongylus quadriradiatus.*

1. Anterior end. (x 230). 2. Region of genital pore *(g.p.)* of female, showing ovijector *(ut.)* and oviduct *(ovi.)* (x 140); 3. Posterior end, female. *an.*, anus. (x 322).

a superficial resemblance to the Trichinellids found with them. The peculiar, four-rayed, chitinous piece connected with the spicules, to which the species owes its name, is just as figured by Stevenson. The vesicular swelling of the cuticle

at the cephalic end is still visible in most of the preserved specimens, and does not appear to have shrunk at all in the glycerine jelly mounts from which the measurements and drawing (Text-fig. 1) were made. Males measured from 6.2 to 6.8 mm. long, with a maximum width, in front of the caudal bursa, of 0.072 to 0.083 mm.; females, 12.3 to 16.2 mm. long, with a maximum width of 0.143 mm. in the region of the genital pore. Cephalic swelling, 0.093 to 0.104 mm. long and 0.046 to 0.052 mm. broad; oesophagus, 0.352 to 0.400 mm. in the male, 0.430 to 0.510 mm. in the female, with an average width of 0.020 mm.; nerve ring, 0.230 to 0.260 mm., and excretory pore, 0.268 mm. from anterior end. The diameter of the body just behind the cephalic enlargement is 0.040 mm. in males, 0.049 mm. in females. The female genital aperture is situated 2.25 to 3.33 mm. and anal aperture 0.140 to 0.156 mm. from tip of tail. The cuticle is marked by a fine transverse striation at intervals of 0.0015 mm., except on the anterior swelling, where the striae are much coarser. Stevenson describes only longitudinal markings, which are also visible on these specimens. The terminal portions of the two divergent uteri, which form the ovijectors, differ slightly from the figures given by Stevenson. Each consists of three parts (Text-fig. 2); the first, opening at the vulva with very thick muscular walls, is about 0.220 mm. long, and is separated by a sphincter, in the form of a prominent ring, from a



Text-figs. 4-6.—*Cephalostrongylus quadriradialus.*

4, Posterior end of male, side view. (x 200); 5. The same, dorsal view. (x200). *v.v.*, ventro-ventral ray; *l.v.*, latero-ventral ray; *e.l.*, externo-lateral ray; *m.l.*, medio-lateral ray; *p.l.*, postero-lateral ray; *e.d.*, externo-dorsal ray; *d.r.*, dorsal ray; 6, male spicules and chitinous support. (x 380).

narrower, but still muscular part 0.117 mm. long, which is continuous with the uterus. Eggs contained in this part of the uterus measure 0.067 by 0.039 mm., and are still in the early stages of segmentation. The genital pore is a transverse

slit 0.040 mm. wide. The body is 0.044 mm. in diameter at the anus. Behind it the slender tail (Text-fig. 3) ends bluntly; the fine terminal spine which it bears, is about 0.015 mm. long, and penetrates the cuticle to connect with the internal protoplasm. It appears to be hollow, and of a glandular nature.

Each lobe of the male bursa (Text-figs. 4, 5) measures about 0.143 mm. in width, and 0.130 to 0.170 mm. in depth. The tips of the two ventral rays are only 0.006 mm. apart. Of the lateral rays, the externo-lateral is the longest, and is curved ventrally, its tip being some distance from the margin of the bursa, and 0.034 mm. from that of the latero-ventral. The distance between the postero-lateral and externo-dorsal is a little less, 0.028 mm. The distances between the tips of the lateral rays are greater, 0.046 mm. between postero- and medio-lateral, and twice as much between medio- and externo-lateral. The prebursal papillae are 0.013 mm. long, and are situated laterally, 0.052 mm. in front of the base of the bursa. The two equal spicules (Text-fig. 6) measure 0.148 mm. long, and taper distally to end in three slender pointed branches, which are surrounded by the chitinous supporting piece, 0.041 mm. long.

Stevenson states that this worm, when present in large numbers, causes a debilitating diarrhoea, and general disorder of the nutritive functions of the host bird. This he thinks to be due both to a loss of blood, and to the piercing of the mucosa, leaving open channels for fatal infection with bacteria. Shipley (1909) includes the species in his list (p. 335) of those harmful to birds, and Neumann-Macqueen (1905), and Neveu-Lemaire (1912), referring evidently to Stevenson's statement, both record it as producing grave disorders, bacterial infection, catarrh, and profuse diarrhoea.

But in this case there was no evidence that the worm, though present in fairly large numbers, caused any harmful effect. The walls of the intestine were not in an inflamed catarrhal condition, and, as already stated, appeared to be perfectly healthy.

Family TRICHINELLIDAE Stiles and Crane, 1910.

Subfamily TRICHURINAE Ransom, 1911.

Genus CAPILLARIA Zeder, 1800.

Generic diagnosis (from Hall 1916).—Body very slender, capillary; anterior, oesophageal portion of body shorter than, or rarely equal to the posterior portion of body. Bacillary band dorsal, ventral, or lateral, or absent. Oesophagus long and slender, gradually increasing in size posteriorly. Spicule long and slender, surrounded by a sheath which may present a smooth outer surface when evaginated, or a surface armed with spines. Tail of male may or may not be provided with membranous wings, and a membranous bursa-like structure, these being usually inconspicuous when present. Vulva located near the base of the oesophagus. Eggs lemon shaped, with the usual opercular plugs.

Type species, *Capillaria tumida* Zeder, 1803 (= *Trichocephalus anatis* Schrank, 1790 = *Trichosoma brevicolle* Rudolphi, 1819).

This genus, established by Zeder to include forms characterised by a filiform body, with a very slender anterior part merging almost insensibly into a rather thicker posterior part, was renamed *Trichosoma* by Rudolphi in 1819. It is under this name that most of its species have since been described, the original name being re-established by Stiles and Hassall only in 1905, when they published their "Determination of Generic Types, and a List of Roundworm Genera."

Most of the descriptions of species are very meagre and unsatisfactory. In 1845 Bellingham remarked that "as the species are all exceedingly small, and resemble each other very closely (almost the only difference being a little greater or less thickness of body), and as the male and female are not always found together, it is very difficult to determine the species accurately." Later helminthologists seem to have experienced the same difficulty, and a good deal of confusion still exists in regard to specific diagnosis.

However, only one species of *Capillaria* has been recorded from pigeons, namely, *Capillaria columbae*, and the worms found here have been identified as belonging to this species. Bellingham did not give any name or description to the Nematode which he found in the small intestine of *Columba livia* in Ireland, but it was probably the same worm. Dujardin, who states that several specimens had been sent to the Museum of Paris from the Museum of Vienna, and were described by him for the first time, supplies the description (1845) which has been repeated, or closely followed, in nearly all subsequent records. In Vienna, according to Dujardin, it was found nine times in 245 in the large intestine of *Columba domestica*. Neumann records it as a frequent and abundant species in the small intestine of this pigeon, and quotes Pauly and Zurn as stating that it often determines an intense intestinal catarrh, which leads to anaemia, and consumption. Neveu-Lemaire also refers to a "trichosomosis" of the pigeon caused by its presence, which had been studied both by Tartakowski and Pauly and Zurn. He says that, at an autopsy of an infected bird, the intestinal mucosa was found to be greyish, tumefied, and covered with red striae and petechiae.

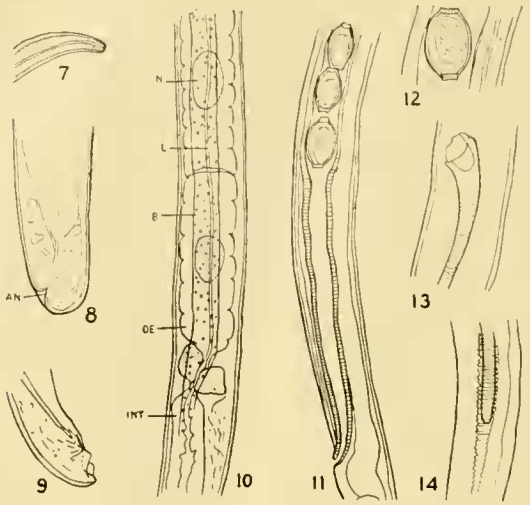
None of these symptoms were observed in the bird, from which the present specimens were obtained, though they were found in fair numbers throughout the intestines.

Capillaria columbae Rudolphi.

Trichosoma columbae, Cat. Ent. Vind. Msc.—1819, Rudolphi, Synops., p. 15.—1845, Bellingham, Ann. Mag. Nat. Hist., xiv., p. 477.—1845, *Calodium tenue*, Dujardin, Hist. Nat. de Helm., p. 28.—1851, *Trichosomum* (*Calodium*) *tenuissimum* Diesing, Syst. Helm., ii. pp. 256, 257.—1861, *Calodium tenue*, Molin Il. soltor. d. Acrofalli, Mem. Instit. Veneto, ix., p. 192.—1863, *Trichosomum tenuissimum*, Eberth, Nemat. Untersuch., Leipzig, p. 56, tab. vi., fig. 2. —1878, Linstow, Compend. d. Helm., p. 119.—1883, Pauly and Zurn, Deutsche Zeitschr. f. Thiermed., ix., p. 200.—1886, Leidy, Proc. Acad. Nat. Sci. Philad., p. 310.—1890, Stossich, Boll. Soc. Adriat. Sc. Nat., Trieste, xii., p. 12.—1895, Railliet, Traité Zool. Méd. et Agric., 2nd edit., pp. 485-486.—1898, *Trichosoma columbae*, Stossich, Program. civ. Scuola reale super., Trieste.—1899, *Trichosoma tenuissimum*, Perroncito, Giorn. R. Soc. Acad. veterin. ital., xlviii., n. 38, p. 889.—1901, Tartakowski, Archiv. veter. Nauk, p. 1045.—1905, Neumann-Macqueen, Parasites and Par. Diseases Dom. Anim., 2nd edit., p. 414.—1906, Barbagallo, Boll. Soc. culto. sc. med.-natur. Cagliari, ii., n. 4, p. 143.—1912, Parona, L'Elmint. Italiana, ii., p. 118.—1912, *Trichosomum columbae*, Neveu-Lemaire, Parasit. Anim. Dom., Paris, pp. 764-765.—1914, *Capillaria dujardini*, Travassos, Brazil-Medico, xxviii., p. 429.—1915, Travassos, Rio de Janeiro, Mem. Instit. Oswaldo Cruz, vii., pp. 153, 160.

Found in about equal numbers with *Cephalostrongylus columbae* in the intestines of the same bird. The measurements correspond fairly closely with those

given by Dujardin. The males are from 8.4 to 11.7 mm. long, and the anterior part, occupied by the oesophagus, is a little less than half the total length, in a specimen 9.7 mm. long the proportions being 4.64 : 5.06. The females measure from 13 to 16.24 mm., and the relative lengths of anterior and posterior portions 6.24 : 10. The diameter at the anterior end is about 0.006 mm. In a male of 11.3 mm., the maximum diameter is 0.049, at the posterior extremity 0.028, at the base of the oesophagus 0.039, and about the middle of the oesophagus 0.026 mm. The spicule, 1.44 mm. long, has an almost uniform width of 0.007 mm., but is swollen at its anterior extremity into a hollow open knob 0.020 mm. wide (Text-fig. 13). At its posterior extremity it is bluntly rounded (Text-fig. 14). It is enclosed in a sheath which is very distinctly marked with transverse striae at intervals of 0.002 mm. in the posterior part, the striae be-



Text-figs.7-14.—*Capillaria columbae.*

7. Anterior end. (x 230). 8. Posterior end of female. (x 230), *an.*, anus; 9. Posterior end of male. (x 230); 10. Region of junction of oesophagus *(oe.)* and intestine *(int.)*. (x 230). *b.*, bacillary band; *l.*, lumen of oesophagus; *n.*, nucleus; 11. Vagina and uterus, containing eggs. (x 140); 12. Egg in terus. (x 230); 13. Anterior end of male spicule. (x 230); 14. Posterior end of spicule, in sheath. (x 230).

coming finer, and more indefinite towards the anterior end. In a few specimens a considerable portion of the sheath is everted, and the spicule is projecting, but in the majority the spicule is withdrawn some distance into the interior of the body. It shows delicate, but irregular, cross markings. The cloacal aperture is terminal, and is provided with a small bursa-like structure, consisting of two lateral lobular projections of the internal protoplasmic substance, connected by a delicate membrane. Travassos states it to be three-lobed, and in side view it has this appearance (Text-fig. 9).

In the females the maximum diameter is 0.060 to 0.067 mm., at the base of the oesophagus 0.049 mm., middle of oesophagus 0.036 mm., and at posterior extremity, which is bluntly rounded (Text-fig. 8), 0.030 mm. The anus is sub-

terminal, and the vulva opens on a very slight prominence 0.026 mm. behind the junction of oesophagus and intestine. The muscular vagina into which it leads is 0.224 mm. long (Text-fig. 11). The eggs nearest to it measure 0.044 by 0.023 mm. There are two lateral baeillary bands extending along the whole length of the body (Text-fig. 10). In both sexes the width is from $\frac{1}{4}$ to $\frac{1}{3}$ the diameter of the body. The spots on their surface, corresponding to unicellular glands, are irregularly distributed, and vary in size. According to Jagerskiold (1901) these glands replace the ordinary Nematode excretory system in this family. The general structure of *Capillaria columbae* corresponds very closely with the description given by Shipley (1909) of *Trichosomum longicolle*. The cells of the "cellular body" or oesophagus (Text-fig. 10) are from 0.096 to 0.143 mm. long, and are marked, by circular constrictions, into a series of from 8 to 12 segments. An oval nucleus (n.) 0.023 by 0.018 mm. in size, is centrally situated in each cell, and the very fine lumen of the oesophagus (Text-fig. 10,*l*) extends through the middle of the single row of cells. Two lobes can be seen of the glandular body situated at the junction of oesophagus and intestine.

In 1914 Railliet and Henry separated the sub-family *Heterakinae* from the family *Ascaridae*, and raised it to family rank, including in it all polymyarian Nematodes in which a pre-anal sucker is present in the male. In this family they included Dujardin's old sub-genus of Ascaris, *Ascaridia*, which had been united by Schneider, and all subsequent workers, with the genus *Heterakis*. The species found in different Columbiformes and commonly known as *Heterakis maculosa* forms one of the thirty-four species enumerated by them as belonging to this genus.

According to this classification, its systematic position is as follows:—

Family HETERAKIDAE Railliet and Henry, 1914.

Genus ASCARIDIA Dujardin, 1845.

Species *Ascaridia columbae* Gmelin, 1789.

Generic diagnosis (from Railliet and Henry 1914).—Mouth with three lips. Oesophagus club-shaped, without bulb. Generally two lateral membranes. Male with feeble caudal wings; spicules equal or sub-equal, without accessory piece; preanal sucker slightly projecting, rounded, with horny ring; papillae relatively large. Female with vulva towards the middle of the body; uteri divergent; eggs with thick shell, with a clear granulation inside the shell, at one of the poles.

ASCARIDIA COLUMBAE Gmelin.

1782, *Ascaris teres*, Goeze, Naturg., p. 84, Pl. 1, fig. 6.—1789, *Ascaris columbae*, Gmelin, Syst. Natur., p. 3034.—1809, *Ascaris maculosa*, Rudolphi, Entoz., ii., 1, p. 158, Pl. 1, figs. 14, 16.—1802, Rudolphi, Wiedem. Areh., ii., 2, p. 22.—1819, Rudolphi, Synops., p. 45.—Bremser, Icones helm., Pl. iv., figs. 25-28.—1842, Civinini, Catal., Lucca.—1844, Bellingham, Ann. Mag. Nat. Hist., xiii., p. 170.—1845, *Ascaridia columbae*, Dujardin, Hist. Nat. d. Helm., p. 219. —1851, Diesing, Syst. Helm., ii., pp. 182-183.—1861, Diesing, Sitz. k. Akad. Wien, xlii. (Revis. d. Nemat.), p. 666.—1857, *Ascaris teres*, Prestal, Allgem. deutsch. naturh. Zeitg., iii., p. 353.—1858, Leuckart, Troehel's Areh., ii., p. 108. —1866, *Heterakis maculosa*, Schneider, Monogr. d. Nemat., p. 72, tab. iii., fig. 11, text-fig.—1871, *Ascaris* sp., Krefft, Trans. Ent. Soc., N.S.W., 2, p. 212.—

1878. *Heterakis maculosa,* Linstow, Compend. d. Helm., p. 119.—1868, *Ascaris maculosa,* Unterberger, Oest. Viert. f. wiss. Veterin., p. 38 —1877, *Heterakis maculosa,* Ercolani, Mem. accad. sc. istit. Bologna, ser. 3, vii., pp. 465-467.—1877, Bassi, Il. med. veterin., Torino, vi., 4, pp. 232-236, and in Giorn. med. veterin. practica, Torino.—1887, Parona, Ann. Mus. civ. Genova, xxiv., ser. 2, iv., pp. 275, 483.—1889, Linstow, Comp. d. Helm., Nacht., p. 43.—1890, Stossich, Boll. Soc. adriat., Sc. nat., xii., p. 49.—1891, Stossich, Boll. Soc. adriat., xiii., p. 109.—1892, Neumann, Traité d. malad. parasit., 2nd edit.—1893, Stossich, Boll. Soc. adriat., xiv., p. 83.—1895, Railliet, Traité d. zool. med. et. agric., 2nd edit., pp. 406-407.—1898, Stossich, Progr. civ. Scuola reale super., Trieste.—1899, Linstow, Mitt. Zool. Samm. Mus. Berl., 1 (2), p. 11, taf. 11, fig. 17.—1896, Galli-Valerio, Manuale parassit., Milano.—1901, Galli-Valerio, Bull. Soc. Vaudoise Sc. Nat., xxxvii., p. 343.—1901, Messner, Zeitschr. f. Fleisch u. Milch hygiene, xi., p. 241.—1902, Perroncito, I parassiti, 2nd edit., p. 380.—1902, Lisi, Il nuo Ercolani, Pisa, an. vii., p. 211.—1905, Stiles and Hassall, Bur. Anim. Indust., Bull., 79, p. 118.—1905, Neumann-Macqueen, Parasit., 2nd edit., pp. 413-414.—1904, Sabrazes and Salm, Gaz. hebd. d. sc. méd. de Bordeaux, p. 117.—1906, Barbagallo, Boll. Soc. cultc. Sc. med.-natur. Cagliari, an. xi., p. 143.—1907, Neumann, Parasites et mal. parasit. des oiseaux dom., pp. 146-148.—1907, Alessandrini, Boll. Soc. Zool. ital., Roma, ser. 2, viii., pp. 220-224.—1907, Alessandrini, Ann. d'Igiene, Roma, n.s.,xvii., pp.323-329, 1 tab.—1909, Alessandrini, Ann. d'Igiene speriment., Roma, p. 497.—1909, Hautefeuille, Amiens Bull Soc. Linn., xix., No. 392, pp. 429-431.—1912, Neveu-Lemaire, Parasitol. Anim. Dom., Paris, pp. 677-679.—1909, Johnston, Proc. Linn. Soc., N.S. Wales, xxxiv., p. 412.—1910, Johnston, Proc. Roy. Soc. N.S.W., xliv., p. 121.—1911, Wolffhugel, Rev. d. Centro Est. de Agronomia y Vet., Buenos Aires, p. 78.—1912, Johnston, Rep. Gov. Bur. Microbiol. N.S.W., ii., p. 135.—1912, *Ascaridia maculosa,* Railliet and Henry, Bull. Soc. Pathol. exot., v., No. 4, p. 251.—1913, *Ascaridia columbae,* Travassos, Mem. d. Instit. Oswaldo Cruz, v., 3, pp. 289, 291, Pl. 28, fig. 16.—1914, *Ascaridia maculosa,* Railliet and Henry, IXe Congrès Internat. d. Zool., Rennes, p. 678.—1918, *Ascaridia columbae,* Johnston, Mem. Queensland Mus., vi., pp. 171-174.

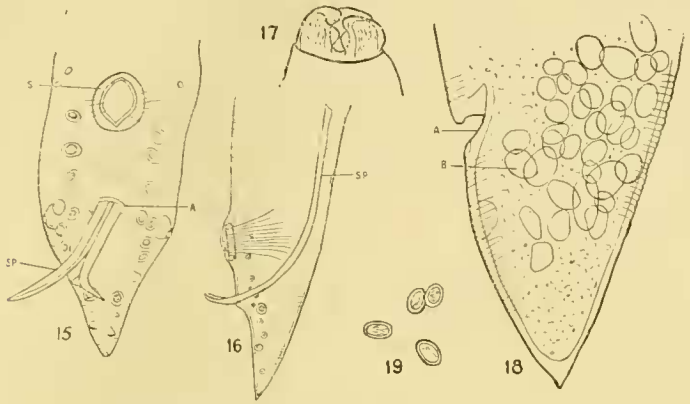
In the same bird which harboured *Cephalostrongylus quadriradiatus* and *Capillaria columbae* were two large specimens, apparently of this worm. One was inadvertently thrown out with the faeces, and the other consists of the posterior half, only, of a female.

More recently, Dr. Cleland handed me a phial containing a large number of preserved specimens of this species. He informs me that they were found in great numbers, closely packed, in the intestines of some young squabs, sent to the Board of Health for post-mortem examination, and were considered to have caused their death.

Dr. Harvey Johnston says (1918, p. 171): "The parasite was found in several Brisbane pigeons, occurring in some of them in considerable number, many of the worms reaching a large size."

In other parts of the world it is a common parasite of the pigeon, and is well known as the cause of a serious, and often fatal, helminthiasis, especially in the case of young squabs; but it has evidently not been noted, hitherto, as the cause of mortality among pigeons in this State. Inquiries from the manager of a large squab company in Sydney elicited the information that several squabs,

ranging in age from three to four weeks, had died within a few months from an unknown cause, and the symptoms described seem to point to the presence of this worm. In view of the importance of the industry of squab raising, and the possibility of successful anti-helminthic treatment, it is desirable that all cases of the occurrence of the worm should be carefully noted. In 1868 Unterberger called attention to the pathological effects of the parasite, and various writers since,



Text-figs. 15-19.—*Ascaridia columbae*. (x 38).

15. Posterior end of male, ventral view; 16. The same, lateral view. *s.*, sucker; *sp.*, spicule; *a.*, anus; 17. Anterior end, showing the three lips; 18. Posterior end of female. *a.*, anus; *b.*, corpuscles in interior of body; 19. Eggs. (x 38).

including Hautefeuille and Alessandrini, have dealt with the same subject. The results of their researches, and the treatment adopted to cope with the disease, are given in most modern text-books on helminth parasitology.

It seems probable that the worm is of fairly general occurrence in pigeons, but only occasionally in such numbers as to give rise to morbid conditions. Early helminthologists, describing this Nematode, make no mention of any disease caused by it.

Some measurements of the specimens found here are:—

Males, 29 to 31 mm. long. Females, 31 to 37 mm. Maximum diameter, 1.3 to 1.6 mm. Diameter at base of lips 0.22 to 0.32 mm. Anus in female 1.20 mm. from tip of tail, in male 0.40 to 0.51 mm. Preanal sucker 0.20 by 0.16 mm. Spicules 1.7 to 1.9 mm. long. Eggs 0.048 by 0.072 mm. The number and arrangement of the papillae on the male tail are shown in Text-figs. 15 and 16. The characteristic, large "orbicular corpuscles" in the interior of the female body, mentioned by Dujardin, from which the specific name *maculosa* was derived, are very noticeable (Text-fig. 18 *b*).

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